Activity Title: Using a GoPro Camera to Count Fish Like a Fisheries Biologist

Subject (Focus/Topic): Science, Collecting and Analyzing Data of Relative Fish Abundance in the Atlantic Ocean, off the Southeast coast of the United States.

Grade Level: 6-8

Average Learning Time: One to Two 50-minute class periods.

Lesson Summary (Overview/Purpose): Students will watch video footage of a trap deployment and will use the footage to calculate the "MeanCount" of each fish species found in the video. It is helpful if the students have already completed the activity entitled "Identifying Fish from Underwater Photos".

Overall Concept (Big Idea/Essential Question):

Scientists are not able to get an exact count of all the fish in the ocean because the ocean is so vast. However, by using a method called MeanCount, scientists are able to compare the "relative abundance" of fish from year to year to help determine if humans are overfishing.

Specific Concepts (Key Concepts):

1. The ocean is vast.
2. If humans catch too many fish, then there may not be fish for future generations.
3. Scientists use many different methods to determine if humans are overfishing.
4. One method to determine "relative abundance" of fish is called "MeanCount".
5. Scientists with SEFIS, the Southeast Fishery-Independent Survey, are currently conducting fish surveys to estimate the relative abundance of fish important to humans, like grouper and snapper.

Focus Questions (Specific Questions):

1. Why can't scientists count all the fish in the ocean?
2. Name one method that scientists use to count fish.
3. How do scientists calculate "MeanCount" of a fish species?
4. What does "relative abundance" mean?

Objectives/Learning Goals:

1. When given a snapshot of video footage, students will be able to identify the Southeast Atlantic fish species in the video footage with at least 80% accuracy.
2. When give a snapshot of video footage, students will be able to correctly count the number of each fish species in the video footage, with at least 80% accuracy.
3. After sharing their findings with the class, students shall be able to calculate the MeanCount of each fish species found in the video footage.

Background Information: This lesson is to simulate what it is like to collect data like a fisheries biologist. The ultimate goal of this lesson is to get kids thinking about how decision makers

decide when a fish species is being overfished.

One set of data that decision makers look at is commercial fish catches. But what happens if a state government or federal government has put a temporary stop on catching a certain fish species? How will they know when the fish population has returned to an acceptable level? One way to collect information is to do an independent fish survey. One group that is doing an independent fish survey on snapper and grouper populations is SEFIS, the Southeast Fishery-Independent Survey.

As part of the independent fish survey, SEFIS deploys chevron traps on hard-bottom habitats along the continental shelf of the Southeast United States. This allows them to get a count of the fish that went in the trap.

They also attach video cameras to the traps. In this manner, they can get a better estimate of the relative abundance of a particular fish population.

This activity does not provide the student with enough information to decide if a particular fish species has been overfished or has recovered. Instead, it is meant to be an introduction to some of the data collecting techniques of a fisheries biologist.

One final note: A fisheries biologist would not count each of the fish species that are found in this video. They would focus their count on the species that were a part of their study.

Common Misconceptions/Preconceptions:

There is an unlimited supply of fish in the ocean.

Materials:

1. A computer, with internet connection, and a data projector to show the video to the class.
2. Optional: computers or tablets with internet connection for the students to access the video
3. Laminated copies of the snapshots from the video.
4. Wet erase markers for each group.
5. A set of fish identification cards from the "Identifying Fish from Underwater Photos" activity for each group.
6. Calculators for each group.
7. Student Handout for each student.
8. The attached excel spreadsheet to collect class data

Teacher Preparation:

You will need to print the 12 snapshots of the video and have them laminated. These snapshots start at the 1-minute mark in the video and continue every 30 seconds. Again, this is a simulation. A fisheries biologist would let the trap "soak" for more than a minute before

collecting data.

I prefer to have students work in pairs for this lesson.

Students will need to correctly identify each fish species. It is helpful to have photos of the fish species, a copy of which is attached. If the students previously completed the "Identifying Fish From Underwater Photos" activity, they can use their fish identification cards instead.

Students should be told in advance that identification will be tricky. For example, a red-colored fish will not look red when it is in deep water. Have the kids brainstorm ways to identify the fish besides color. Body shape, tail shape, fin shape, and unique markings are some suggestions. Besides the attached photos, a poster of Southeast Atlantic fish species or a fish identification book would help with this identification process.

Students will need to be able to correctly count each fish species. This is also tricky to count of the computer screen. It is helpful to have a printout of the snapshot of the fish to be counted and to have this snapshot laminated. That way, the students can use a wet erase marker to count a fish species. It can be easily erased and be ready for your next class.

It is also helpful to have the video footage available to the students on a classroom computer. That way, if one fish is hard to identify because it is partly off-screen or behind another fish, the students can go to the correct spot on the video and rewind or go forward frame by frame to identify the hidden fish.

Be aware that is a modified version of calculating MeanCount. Scientists typically use a 20 minute video segment with 40 snapshots (each at 30 second intervals).

Also, there are more fish in the video than appear on the fish identification cards. For example, in the "1 minute" snapshot, observant students may notice a Spanish hogfish. A fish identification book or an online resource like the ones listed at the end of this lesson could help the students with the fish that are not included in the fish identification cards.

Keywords:

1. Vast
2. Fish Species
3. Relative Abundance
4. MeanCount

Lesson Procedure:

If the students have previously completed the "Identifying Fish from Underwater Photos, skip to Part C below.

A. Warm Up (5 minutes): Ask the class,

Why is it important to try to count the number of fish in the ocean?

How do people estimate the number of fish in the ocean?

B. Whole Class Activity (the "Hook"). Discussion and Video

After the students have discussed their ideas from the warm up, explain to the class that one method used to count fish in the ocean is to actually catch the fish with a fishing pole or with a trap. Once the fish are brought to the surface, people can count each type of fish caught.

However, this method doesn't necessarily give us a true picture of the fish population because there are fish that just swim by the bait and don't actually go into the trap or get hooked.

So, scientists are using technology to help get a better idea about the number of fish in the ocean. One way to do this is with a waterproof video camera, like a Go Pro camera.

Scientists attach video cameras to their traps. By using the cameras, they get to see not only the fish that get caught in the trap when they bring the trap to the surface, but they also get to see the fish that decided not to go into the trap.

Show the students the video of the trap deployment, if they have not seen it already. You can find the video at https://vimeo.com/118430541.

C. Pair Activity –

Explain to the students that they are going to be fisheries biologists today and will calculate the "MeanCount" of each fish species found in the video. To calculate the MeanCount, they will not count every fish in the video. Instead, they will work with a partner and will get one snapshot of the video (snapshots were taken every 30 seconds) and will count the number of each fish species in that snapshot. This is the first step in trying to find the MeanCount.

Then, give each pair a laminated copy of one of the snapshots from the video and a student handout. The goal of each pair of students is to:

1. Correctly identify all the fish species in the snapshot.
2. Correctly count the fish species in the snapshot.
3. Record their findings in the "Step 1" section of the student handout.
4. Share their data with the class.

It is helpful if the students have their fish identification cards from the prior lesson. It will help them identify fish in the video. You may wish to review the correct names and matches before they begin identifying and counting the fish in their snapshot. Some students will misidentify the tomate and the spottail pinfish because of the markings on the tail. You should tell them to be very observant when trying to identify either of these fish species.

D. Whole Class Activity (Calculating MeanCount).

To calculate the MeanCount, students need to determine the total number of fish in each video snapshot and need to know the total number of snapshots that the class examined. These steps

are broken down below.

Whole Class, Step 1. Finding the total number of fish from all the snapshots. Have the students share their data with the class for the number of each fish species identified in the video segment. They need to rely on one another in order to get an accurate count of the total number of fish in all the video snapshots.

You can have the students come up with a way to combine their data or you can poll each group and write the data on the board. Alternatively, you could use the attached Excel Spreadsheet with each student group entering their data into the spreadsheet.

Whole Class, Step 2. Calculate the MeanCount for each fish species. Using calculators, have the students divide the total number of a specific fish species by the total number of snapshots to determine the MeanCount of that fish species. For example, if the class determined that there were 9 vermilion snapper that they identified in the snapshots, they would divide 9 by 12 (the total number of snapshots used in this simulation). The MeanCount for vermillion snapper would be .75. So, the MeanCount of a fish species is just the average number of that fish species found in these snapshots.

E. Closure:

Students should complete the handout.

Assessment and Evaluation: There are several different ways that you can assess and evaluate this activity:

A. Processing Data – You can grade them on how accurately they processed the data.
B. Reflecting – You can grade them on how well they reflected on the bigger ideas of this lesson. See the student handout for reflection questions.
C. Collaboration – You can assess them on how well they collaborated with one another to come up with the MeanCount of each fish species.

Standards:

- **National Science Education Standard(s) Addressed:**

49. Changes in Environments.

50. Science and Technology in Local Challenges

- **Ocean Literacy Principles Addressed:**

Essential Principle 6. THE OCEAN AND HUMANS ARE INEXTRICABLY INTERCONNECTED.

D. Humans affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean… In addition, humans have removed most of the large vertebrates from the ocean.

G. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Correlation to Next Generation Science Standards:

MS-ESS3: Earth and Human Activity

HS-ESS3: Earth and Human Activity

- **State Science Standard(s) Addressed:**

  - S6CS3. Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.
  - S6CS9. Students will investigate the features of the process of scientific inquiry.

- **(Optional) Additional Resources:**

  Kevin M. McMahon, GoPro Science, July 11, 2014, https://teacheratsea.wordpress.com/2014/07/13/kevin-mcmahon-gopro-science-july-11-2014/

  As an extension, some students may explore why colors of fish look differently at different depths. See, "What is Bright, Red and Invisible? " at http://oceanexplorer.noaa.gov/explorations/02hudson/background/edu/media/hc_bright_red.pdf

  To learn more about the Southeast Fishery–Independent Survey, visit: http://www.sefsc.noaa.gov/labs/beaufort/ecosystems/sefis/

  Fish identification resources include:

  www.fishwatch.gov

  http://www.marinefishesofgeorgia.org

  http://portal.ncdenr.org/web/mf/fish-finder

  http://safmc.net/fish-id-and-regs/regulations-species

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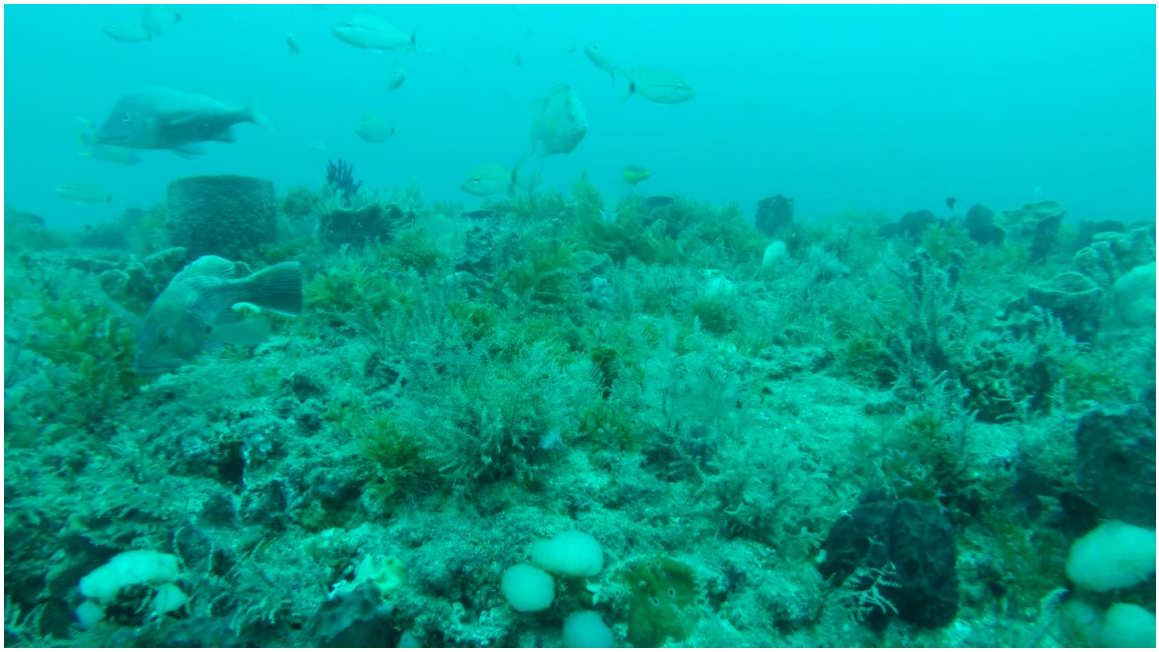
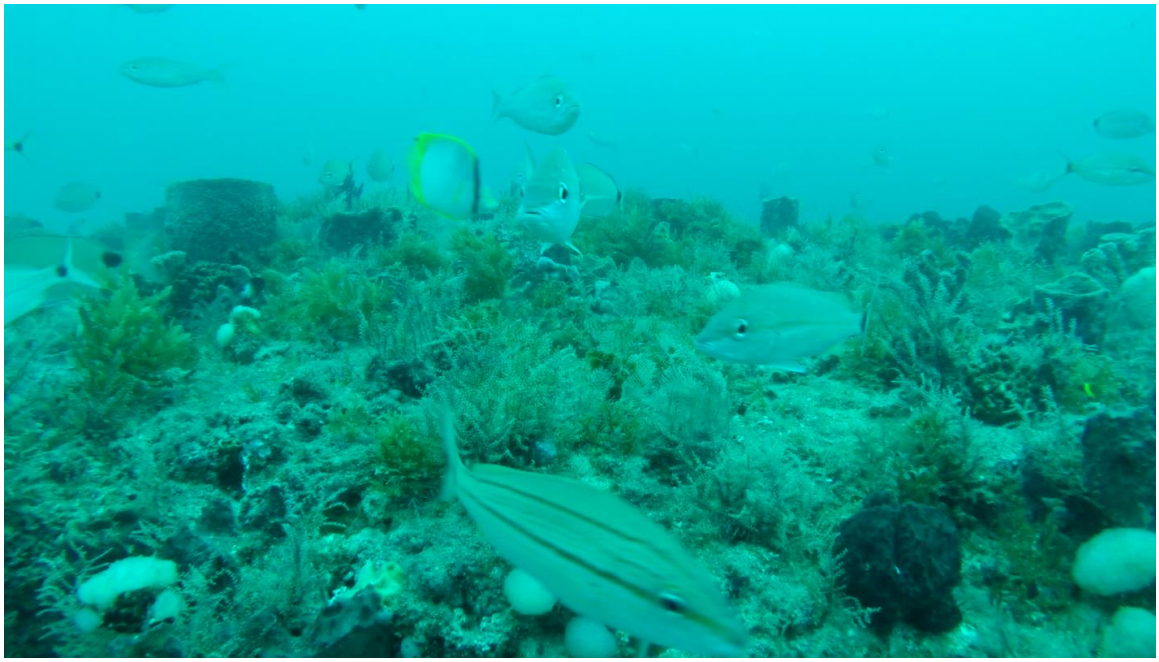
One minute, thirty second fish count:

One minute fish count:



Two minutes, thirty seconds fish count:

Two minute fish count:



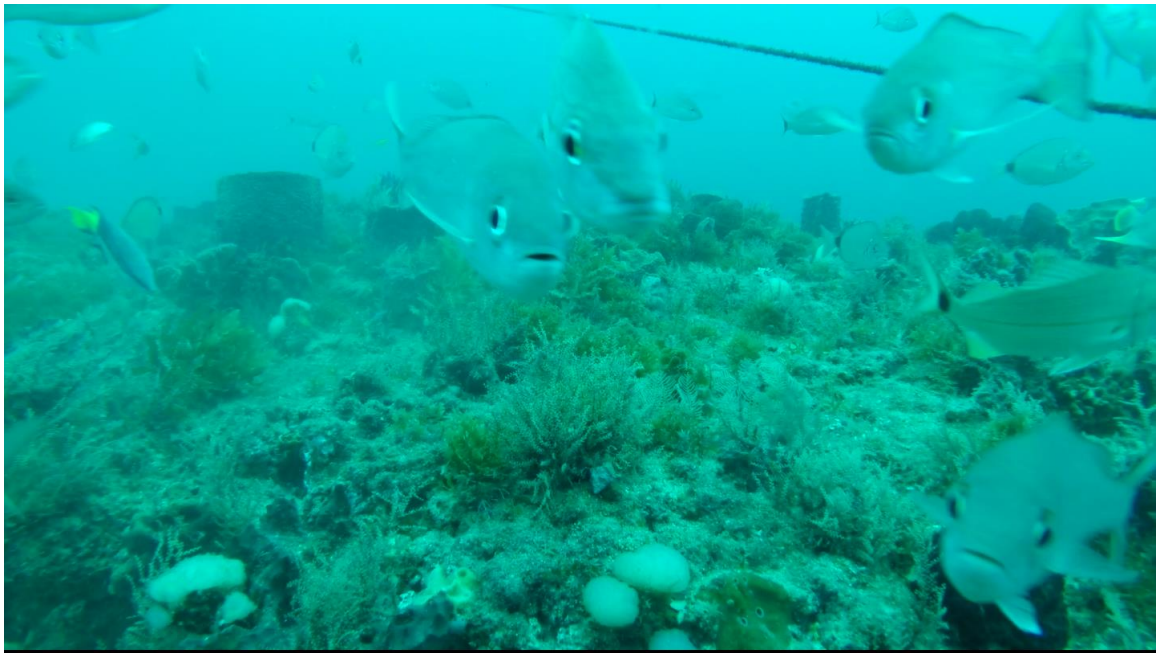
Three minute, thirty second fish count:

Three minute fish count:

Four minute, thirty second fish count:

Four minute fish count:

Five minute, thirty second fish count:

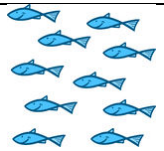


Five minute fish count:

Six minute, thirty second fish count:

Six minute fish count:

Name:_____ Date:_____ Class:_____

Using GoPro Cameras to Count Fish	

In this activity, you will be a fisheries biologist and will be working with other fisheries biologists to calculate the "MeanCount" of most fish species in the video clip shown by your teacher. Follow these 3 steps to calculate the MeanCount.

STEP 1 (With your partner). Count the number of each fish species in the video snapshot that was given to you and write your answers below. If another group is looking at the same video snapshot, compare your answers and decide who has the most accurate data.

	Black Sea Bass	*Blue Angelfish*	*Butter-flyfish*	*Hogfish*	*Scamp*	*Spottail Hogfish*	*Spottail Pinfish*	*Tiger Shark*	*Tomtate*	*Vermilion Snapper*	*White Grunt*	Yellowtail Snapper
_____ [Write minute mark of your video snapshot here. Ex: 1 minute]												

(TURN)

STEP 2 (with your class). When other groups share their data, write their fish counts below:

	Black Sea Bass	*Blue Angelfish*	*Butter-flyfish*	*Hogfish*	*Scamp*	*Spottail Hogfish*	*Spottail Pinfish*	*Tiger Shark*	*Tomtate*	*Vermilion Snapper*	*White Grunt*	Yellowtail snapper
1 minute												
1 minute 30 s												
2 minutes												
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4 minutes												
4 minutes 30 s												
5 minutes												
5 minutes 30 s												
6 minutes												
6 minutes 30 s												
TOTAL NUMBER OF FISH												

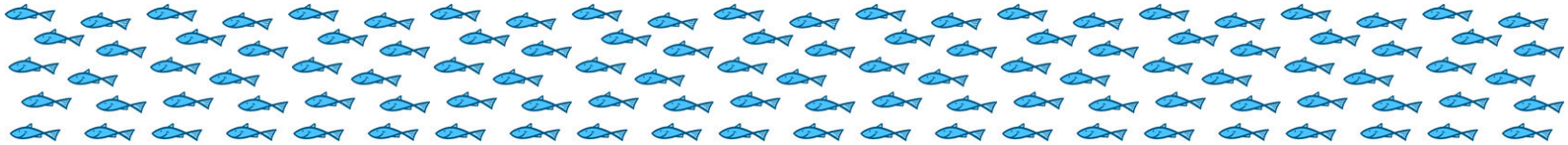
STEP 3 (with your partner). From the data in Step 2 above, calculate the MeanCount of each fish species by dividing the total number of fish counted by the number of snapshots viewed, which is 12 for this activity. For example, if the total number of tiger sharks is 2, the MeanCount is 2/12 or .1667.

MeanCount for each fish species

	Black Sea Bass	*Blue Angelfish*	*Butter-flyfish*	*Hogfish*	*Scamp*	*Spottail Hogfish*	*Spottail Pinfish*	*Tiger Shark*	*Tomtate*	*Vermilion Snapper*	*White Grunt*	Yellowtail Snapper
	___/12	___/12	___/12	___/12	___/12	___/12	___/12	___/12	___/12	___/12	___/12	___/12
MeanCount												

Name:_____ Date:_____ Class:_____

STEP 4 (by yourself). Reflection



1. What fish species had the largest MeanCount in this activity? _____.

2. What fish species had the smallest MeanCount in this activity? _____.

3. Can you make any conclusions from this activity about whether these numbers of these fish are increasing, decreasing, or staying the same? _____. Why or why not?

4. What other information would you like to have before making a conclusion about whether a fish population is increasing, decreasing, or staying the same?

5. What are some advantages to counting fish using GoPro cameras instead of counting fish by the number caught in a trap?

Using GoPro Cameras to Count Fish

Number of Fish Observed

	Black Sea Bass	*Blue Angelfish*	*Butter-flyfish*	*Hogfish*	*Scamp*	*Spottail Hogfish*	*Spottail Pinfish*	*Tiger Shark*	*Tomtate*	*Vermilion Snapper*	*White Grunt*	*Yellowtail Snapper*
1 minute												
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TOTAL NUMBER OF FISH												